

AFOSR 70-2564TR

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FINAL REPORT

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Short Title of Work	:	Research in Geoacoustics and Seismology

by

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### TECHNICAL SUMMARY

Efforts during this reporting period (1 July 1969 to 31 August 1970) have been directed toward the tasks outlined in a Project Proposal submitted to AFOSR, SRPG with covering letter dated February 19, 1969.

To assist the group at Lamont-Doherty Geological Observatory in their program to evaluate the effects of barometric pressure fluctuations on the data recorded by inertial seismic equipment we shipped them DL, S/N 5 (an incremental, digital recording, magnetic tape system, title vested in ARPA) plus three microbarograph systems modified to provide for both digital and analog graphic recording. This equipment was followed by visits of ESSA personnel to advise on the proper operation and maintenance of this equipment.

To assist the group at the University of Michigan in their program to evaluate the effects of barometric pressure fluctuations on the data recorded by long period inertial seismic equipment two microbarographs were shipped to them. These are equipped for both digital and analog graphic recording. ESSA personnel assisted in the installation of these units at Sugar Island, Michigan. At the present moment a third instrument is being prepared for shipment. This will permit an evaluation of the effects of horizontal pressure gradients on the seismic instruments.

The principal investigator visited Dr. Fuchs of Ciudad Universitaria, Cordoba, Argentina. Partly as a result of this visit and using funds available to AFOSR under other programs, plans are going forward to establish a Geoacoustics Station at Cordoba. Data from this location should help us to determine the cause of the persistent low level signals now being recorded at Huancayo and La Paz.

DL, S/N 4 (vide supra) has been shipped to La Paz. Shipping damage resulted in component failure which resulted in the following format changes: a) Time information in the header block is nonsense. b) Inter-record gaps occur every minute instead of every two minutes. Pending the writing of modified programs to read this format it is presumed that the data is valid. Replacement components are on order.

Three microbarograph systems based upon the use of thermoelectric generators at the outposts with radio transmission of the data to the Central Recording Site, have been placed in operation at Peñas, Bolivia. Graphic Records received at ESSA indicate that these systems, designed for a ten mile line-of-site range, operate satisfactorily at distances up to 23 km. It is hoped that the absence of wire lines will reduce outages caused by lightning. The array at Peñas now has seven operating outposts.

During a visit to La Paz the principal investigator examined microbarographs of somewhat different design from those supplied by ESSA. The noise reducing array is based upon different principles from those of the Daniel's pipe.

Three sets of equipment consisting of thermoelectric generators, radio transmitters, receivers, discriminators, etc. are presently packed for shipment to Huancayo, Peru. Present plans are to use these items to replace the existing wire lines and thus increase the reliability of the equipment at Huancayo. If, or when, D-1 S/N 5 is returned from Lamont consideration will be given to increasing the Huancayo array from four to seven elements.

Hi-speed signal searches of analog magnetic tape have been completed as follows:

Boulder, Colorado	1 Jan. 69 to 1 July 70
College, Alaska	1 Jan. 69 to 26 July 69
and	1 Oct. 69 to 28 Feb. 70
Huancayo, Peru	3 Jan. 69 to 30 Nov. 69
and	1 Jan. 70 to 1 Apr. 70
Peñas, Bolivia	1 Jan. 70 to 1 Apr. 70
Tel Aviv, Israel	1 Jan. 69 to 31 May 70
and	9 June 69 to 1 May 70
Pullman, Washington	75% of 3 June 69 to 30 July 70

A number of intervals on these records have been examined in more detail but much collating of data remains to be done.

A number of signals from known sources were analyzed in detail as soon as the magnetic tape became available. The results of these analyses were reported to those having an immediate interest in the data.

#### RELEVANCE TO VELA PROBLEMS

By its very nature this project, in past years, has been primarily aimed at providing equipment and technical support to other organizations so that they can more readily examine the various factors bearing on many VELA problems. For instance, the problem of barometric loading of the earth's surface as it affects the data from long period inertial seismographs is yielding to the efforts of Dr. Herrin at SMU, Dr. Pomeroy at the University of Michigan, the group at Lamont-Doherty Geological Observatory and Fr. Fernandez, at the Observatorio San Calixto, all of whom have been supplied ESSA microbarographs for obtaining the barometric data. There is also data available from the LASA-LAMA complex which

has not, to the writer's knowledge, been adequately evaluated.

The logistic and technical support provided under this ISSA to the Geoacoustics Stations at Huancayo, Peru and Peñas, Bolivia permits them to provide data bearing on atmospheric propagation as it bears on VELA Problems.

Our library of acoustic data has been made available to other groups on request, either by loan of the original magnetic tape records or by the recreation of analog graphic records.

Under this ISSA the group is, for the first time, carrying out a systematic search of all analog magnetic tape records available to us. Proper interpretation of the results of this search will lead to a better understanding of the vagaries of atmospheric propagation and of naturally occurring sources of infrasound.

#### PUBLICATIONS

A number of papers were presented by the group at an ARPA sponsored meeting held on 26/27 Feb. 1970. It is the writer's understanding that the proceedings of this meeting are to be published.

The loan of equipment as indicated above, is believed to have contributed materially to the quality and quantity of publications under other ARPA sponsored projects.

A manuscript is in draft giving the results of both analog and digital analyses of the signals received at Huancayo, Peru and Peñas, Bolivia from volcanic activity in the Galapagos Islands.

#### FUTURE PLANS

Under ISSA-70-0003 logistic support will be continued for Geoacoustic and Seismic investigators. Work will continue on in-house analysis of records in a systematic way.

#### FISCAL DATA

It must be emphasized that the fiscal data herein reported are estimates only. Formal accounting documents must originate in ESSA Headquarters.

6 NOV 1970

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13. ABSTRACT

The Geoacoustics Group of the Environmental Research Laboratories sponsors and monitors a geoacoustics network in the United States, South America, and Israel. Data from these stations is used to carry out a systematic search of all received analog magnetic tape records. Proper interpretation of the results of this search will lead to a better understanding of the vagaries of atmospheric propagation and of naturally occurring sources of infrasound.

A library of seismic and acoustic recordings received from the various stations is maintained for use by other interested groups.

The group serves as technical advisors in the building, maintenance, and repair of equipment necessary to the operation of a geoacoustics station. The group also serves as liaison for the various stations.

#### KEY WORDS

acoustics  
air-to-earth coupling  
geoaoustics  
infrasound